(12) UK Patent Application (19) GB (11) 2 356 229 (13) A

(43) Date of A Publication 16.05.2001

(21) Application No 0022977.3

(22) Date of Filing 19.09.2000

(30) Priority Data
(31) 09399399 (32) 20.09.1999 (33) US

(51) INT CL[7]
E21B 43/01 33/038 , F16L 5/00

(52) UK CL (Edition S)
F2G G13 G9J G9K
U1S S1884

(56) Documents Cited
GB 2107810 A GB 1391717 A WO 98/41729 A1
US 4706757 A US 4633801 A US 4208055 A

(58) Field of Search
UK CL (Edition S) F2G G9K G9L
INT CL[7] E21B 17/00 17/08 33/038 43/01 , F16L 5/00 5/02 27/10 41/00
Online: WPI, EPODOC, JAPIO

(71) Applicant(s)
Mentor Subsea Technology Services, Inc.
(Incorporated in USA - Delaware)
PO Box 60035, 1450 Poydras Street, New Orleans, Louisiana 70112, United States of America

(72) Inventor(s)
Gautam Kumar Chaudhury

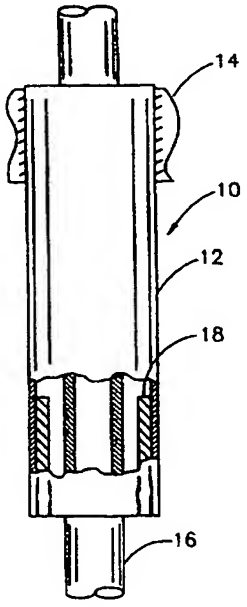
(74) Agent and/or Address for Service
D Young & Co
21 New Fetter Lane, LONDON, EC4A 1DA, United Kingdom

(54) Abstract Title

A sleeve joint for use with a pipe in an offshore structure

(57) A sleeve joint for use with a pipe in an offshore structure where the pipe is subject to bending movements caused by wind, currents, and wave action. The pipe has one end connectable to the sea floor and an upper portion adapted to pass through an opening in the offshore structure. The sleeve joint comprises a tube 12 rigidly attached to a support structure 14 on the offshore structure, which has an inner diameter greater than the outer diameter of the pipe. Preferably the tube is provided with an inner liner 18 between the pipe and the tube at the free end of the tube in order to reduce frictional wear.

FIG. 1



GB 2 356 229 A

FIG. 1

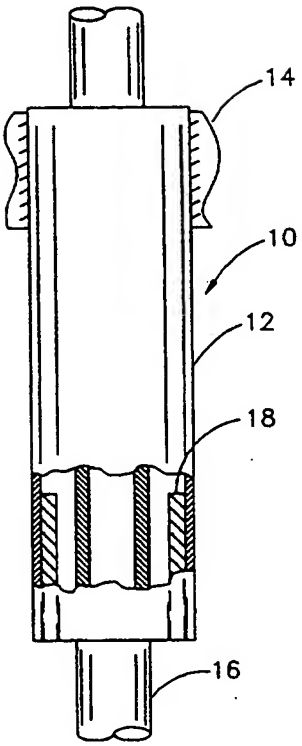


FIG. 2

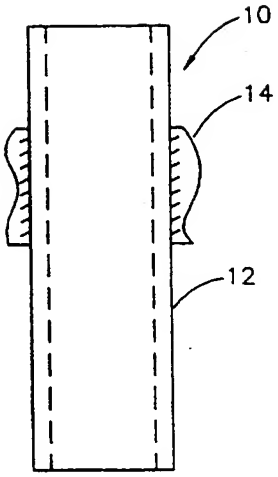


FIG. 3

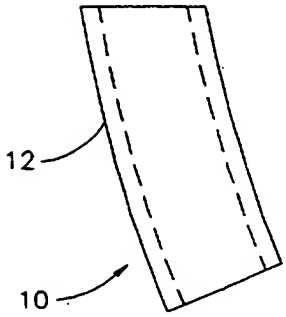


FIG. 4

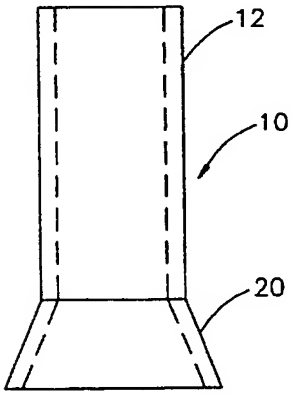


FIG. 5

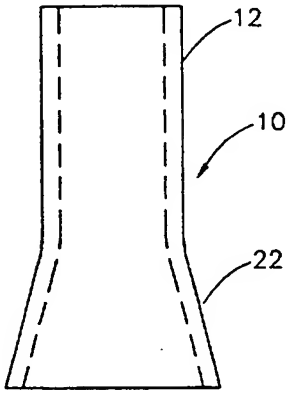


FIG. 7

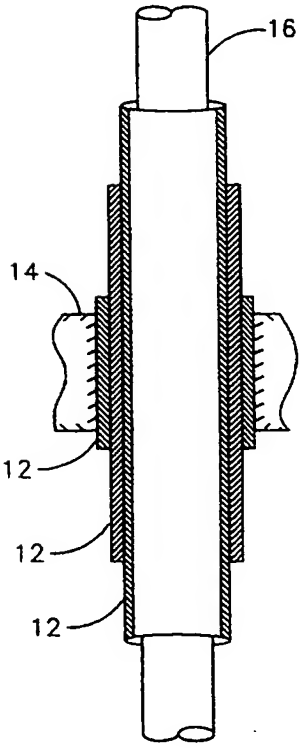
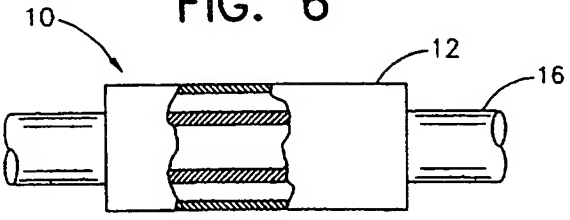


FIG. 6



USE OF SLEEVE JOINTS TO CONTROL MOMENT IN PIPES

The invention generally relates to the use of sleeve joints to control moment in pipes, such as in the production of hydrocarbons from subsea formations, for the support of risers and tendons used in such production.

In the drilling and production of hydrocarbons offshore, the development of deep water operations includes the use of tendons and risers under tension that extend from the sea floor to a surface structure that may be floating or fixed. The configurations of these pipes between the surface structure and the sea floor can be substantially vertical, at an angle, and/or curved.

The lower ends of the tendons and risers are connected to the sea floor by means of additional pipes or risers embedded in and grouted to the sea floor. They may be connected to some gravity base structure on the sea floor. The pipes may rest on the sea floor for some distance and be supported by some means or may continue to be a part of offshore pipeline. The upper ends of the tendons and risers pass through openings in a portion of the surface structure and may be supported vertically by some means located above or below the water surface.

Floating surface structures and fixed structures such as compliant towers are both subject to environmentally induced forces or motions that cause bending of the tendons and risers at the opening into the structure. The tendons and risers themselves are also subject to bending moments from currents and

waves even when used with rigid surface structures. The bending moments on the tendons and risers normally under tension result in fatigue and wear at the opening into the surface structure. These bending moments may also occur at the lower end of the riser at the sea floor.

The known art provides a number of different means to address the problem, but there is still a need for improvement.

The invention addresses the above need. What is provided is an external sleeve joint that separates the riser pipe from the joint. The sleeve joint is a length of tube, as required for the integrity of the pipe through it, which is supported at any desired location on the sleeve. The support point of the sleeve is fixed to a structure to prevent relative movement of the sleeve at the support. The sleeve may be straight, curved, and a combination of both. The sleeve is formed from a tube with an inner diameter that allows the riser pipe to fit through the tube. An inner liner may be used at the free end of the sleeve to reduce frictional wear.

Another aspect of the invention is set out in claim 1.

The invention will now be described by way of example with reference to the accompanying drawings, throughout which like parts are referred to by like references, and in which:

Fig. 1 is a side view of one embodiment of the invention; and

Figs 2 to 7 illustrate alternative embodiments of the invention.

Referring to the drawings, it is seen in Fig. 1 that a sleeve joint 10 is comprised of a tube 12 that is rigidly attached to a support structure 14 that is part of a larger offshore structure, at the surface or at the seafloor, not shown. The tube 12 has an inner diameter that is larger than the outer diameter of a riser or tendon 16 and thus is sized to receive the same or similar pipe 16. It should be understood that a riser is a term of art used in the oil industry to refer to a pipe used for certain purposes and that the riser may also be referred to as a pipe.

Fig. 1 illustrates the tube 12 attached to the support structure 14 at the upper end of the tube 12. However, it should be understood that the tube 12 may be attached to the support structure 14 at any position on the tube that is suitable to the situation and equipment. As an example, Fig. 2 illustrates the tube 12 attached to the support structure 14 near the mid-section of the tube 12.

As seen in Fig. 1, an inner liner 18 may be provided at the free end of the tube 12 to reduce frictional wear on the riser 16 and tube 12.

Fig. 3 illustrates an alternate embodiment where the tube 12 is curved to match the natural curve that a riser might assume after installation offshore.

Fig. 4 illustrates an alternate embodiment where the lower end of the tube 12 is provided with a conical end 20.

Fig. 5 illustrates an alternate embodiment where the lower

end of the tube 12 is provided with a flared end 22. The embodiments of both Fig. 4 and 5 will allow for movement of the riser 16 with minimal wear on the riser and tube.

Fig. 6 illustrates an alternate embodiment where no inner liner is used between the tube 12 and riser 16. Fig. 6 is illustrated in a horizontal position since the invention may also be used to support a riser in the horizontal position. This applies to the situation where the riser rests in a horizontal position on the sea floor or some other structure.

Fig. 7 illustrates an alternate embodiment where the joint 10 is formed from a plurality of tubes 12 placed concentrically within each other.

The tube 12 may be of any length suitable for the integrity of the riser 16. The diameter and wall thickness of the tube 12 may be varied along the length of the tube 12. The tube 12 may also be formed from a combination of straight and curved sections. Both the tube 12 and the riser 16 may be coated with any suitable coating to resist frictional wear.

The invention provides several advantages. Cost savings are realized as a result of the elimination of expensive stress joints or flex joints and, in some cases, additional receptacle structures. The riser system is more redundant because the joint is not an integral part of the riser. Design and fabrication of the sleeve joint 10 is simpler and more reliable than complicated joints and thus can be delivered more quickly. The sleeve joint 10 provides for easier and less expensive offshore installations.

Because many varying and differing embodiments may be made

within the scope of the inventive concept herein taught and because many modifications may be made in the embodiment herein detailed in accordance with the descriptive requirement of the law, it is to be understood that the details herein are to be interpreted as illustrative and not in a limiting sense.

CLAIMS

1. A sleeve joint for use with pipe in an offshore structure wherein the pipe is subject to bending moments caused by wind, currents, and wave action, the pipe having one end connectable to the sea floor and an upper portion adapted to pass through a constraining opening in the offshore structure, the sleeve joint comprising a tube rigidly attached to a support structure on the offshore structure, with the tube having an inner diameter greater than the outer diameter of the pipe.

2. The sleeve joint of claim 1, wherein said tube is attached to the support structure at one end of said tube.

3. The sleeve joint of claim 2, wherein said tube is provided with an inner liner between the pipe and said tube at the free end of said tube.

4. The sleeve joint of claim 1, wherein said tube is attached to the support structure approximately at the mid-point of said tube.

5. The sleeve joint of claim 1, wherein said tube is curved.

6. The sleeve joint of claim 1, wherein one end of said tube is flared outwardly.

7. The sleeve joint of claim 1, wherein a plurality of said tubes are placed concentrically within each other.

8. A sleeve joint substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

INVESTOR IN PEOPLE

Application No: GB 0022977.3 7 **Examiner:** Gareth Prothero
Claims searched: 1 to 8 **Date of search:** 12 March 2001

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): F2G (G9K, G9L)

Int Cl (Ed.7): E21B 17/00, 17/08, 33/038, 43/01; F16L 5/00, 5/02, 27/10, 41/00

Other: Online: WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2107810 A	(SHELL) See abstract and figs.	1 & 2
X	GB 1391717 A	(SUBSEA) See fig.	1, 2 & 6
X	WO 98/41729 A1	(COFLEXIP) See abstract and figs.	1 to 3, 5 & 6
X	US 4706757 A	(HARRINGTON) See support member 18.	1, 4 & 6
X	US 4633801 A	(MARSHALL) See whole document.	1 to 3, 5 & 6
X	US 4208055 A	(NOENSIE et al.) See figs.	1, 2, 4, 6 & 7

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.